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Physical Therapy Management of a Patient with Opioid Induced Rhabdomyolysis: A Case Study

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Abstract

Background: Rhabdomyolysis (RM) is a condition that is the result of muscle breakdown, typically occurring in cases of over-exertion, immobility, or trauma. Symptoms of RM include edema, weakness, stiffness, and painful mobility. The purpose of this case study is to describe the successful implementation of physical therapy (PT) interventions in a patient hospitalized with RM secondary to opioid overdose. The patient's clinical findings, intervention timeline, and outcomes will be discussed in this case report. **Case Description:** The patient is a 48-year-old female who was admitted to the hospital following opioid overdose. The patient was diagnosed with opioid-induced RM and acute kidney injury. The patient was hospitalized for 3-weeks before discharging home with home care. **Outcome Measures:** The patient scored 11 on the AM-PAC Basic Mobility on initial evaluation and was able to improve score to 23 at discharge. Additionally, the patient's bed mobility, transfers, gait, and stair negotiation significantly improved throughout hospital stay. **Discussion:** Evidence-based researched is limited regarding PT treatment in patients with RM. This patient demonstrated improved functional mobility throughout hospital stay, however, continued to be limited due to pain in bilateral lower extremities. Thorough sensory testing should be administered and monitored throughout the hospital length of stay.

Keywords: Rhabdomyolysis; opioid use; acute care; physical therapy; rehabilitation

Background

Rhabdomyolysis (RM) is a condition that is the result of muscle breakdown, typically occurring in cases of over-exertion, immobility, or trauma.[2,3,4,8,9] In fact, one of the most common cause of RM is over-exertion.[9] This usually occurs in untrained individuals, dehydrated athletes, or when exercising in extreme heat.[9] Toxins and drug overdose are other causes of RM[4,5]. The most common drug overdose that can lead to RM is alcohol intoxication[4]. Ethanol depresses the central nervous system (CNS) and can create periods of immobility[4]. Opioid-induced RM is less common, and typically occurs due to prolonged immobility, muscle ischemia, and depression of the CNS[4]. Additionally, RM can occur during traumatic events, infection, genetic and autoimmune disorders, and endocrine disorders.[4,9]

More specifically, RM occurs following destruction of skeletal muscle, causing intracellular contents to leak into the circulatory system and extracellular contents to move into the cell.[3,4] Skeletal muscle destruction is caused in three ways: direct injury to the cell membrane, muscle cell hypoxia, and/or disruption of the sodium-potassium (Na+/K+) pump.[4,]

The cell membrane acts as a barrier that keeps intracellular and extracellular contents separated.[4] When the membrane is damaged, apoptosis and protease pathways are activated through free-ionized calcium entering the intracellular space.[2,5] Direct injury to the membrane occurs secondary to “crushing, tearing, burning, pounding, poisoning, or dissolving;” mechanisms that typically occur in traumatic events.[4] Oxygen is utilized to produce ATP, which is needed to maintain the Na+/K+ pump and contractile apparatus of muscle.[4,8] During hypoxic states, oxygen is limited, and the body is unable to maintain the production of ATP, therefore the Na+/K+ pump breaks down.[4,13]

Function of the Na+/K+ pump is necessary to maintain the distribution of intracellular and extracellular ions.[2,4] When this is disrupted, the body can no longer function properly. Additionally, the Na+/K+ pump function is disrupted following extreme losses of sodium or potassium in the body.[2] Copious amounts of potassium are lost during “excessive vomiting, diarrhea, or extensive diuresis.”[4]

Because of the electrolyte imbalances, patients typically present with edema, weakness, stiffness, pain with mobility, edema, malaise.[2,4,7,9,13] When these symptoms are seen in other diagnoses, they can typically be treated with physical therapy (PT). However, in cases of RM, PT treatment is not well distinguished.

While it may seem counter intuitive to stress the musculoskeletal system in a condition characterized by muscle breakdown, loss of function, immobility, and deconditioning need to be addressed and minimized to allow the patient to recover and return to their prior level of function (PLOF).

While general recommendations are available for the rehabilitation of RM, little controlled research is available for PT treatments in patients with this condition. Because of this, it is unclear which therapy parameters to use when treating these patients. Thus, the purpose of this case study is to describe the successful implementation of PT interventions in a patient hospitalized with RM secondary to opioid overdose. The patient’s clinical findings, intervention timeline, and outcomes will be discussed in this case report.

Case Description

The Patient is a 45-year-old female found slumped over the kitchen counter in the morning by her husband, where she had likely been all night. She was found wearing three Fentanyl patches and taking much more Ambien than prescribed. She was admitted to the local intensive care unit where her creatine kinase (CK) level was >20,000 U/L and creatinine (Cr) level was 2.2 mg/dL. Three days later,

she transferred to a larger hospital for nephrology needs. There, she was diagnosed with RM and Acute Kidney Injury (AKI) secondary to accidental overdose (OD). She has a past medical history of chronic low back pain, hyperlipidemia, hypertension, hypothyroidism, thyroid cancer, and obstructive sleep apnea on CPAP.

Clinical Impression #1

Four days after she was found with accidental OD, she was evaluated by PT. At this time, she was not orientated to time, presented with significant lower extremity and facial edema and bruising, and had not been out of bed since prior to her OD. Prior to hospitalization, she was completely independent with all activities of daily living (ADLs), instrumental activities of daily living (IADLs), ambulation, and stair negotiation.

Examination

Manual Muscle Test (MMT)

The patient's lower extremity strength was tested sitting edge of bed. She demonstrated general weakness throughout bilateral lower extremities (LEs) during testing. She was able to follow commands at time of assessment. The results of the MMT during initial visit are as shown in **Table 1**.

AM PAC Basic Mobility

Activity Measure for Post-Acute Care (AM-PAC) instrument, also known as 6-clicks, was developed by researchers to measure basic mobility, daily activities, and applied cognition.[10] For this case study, I used the AM-PAC Basic Mobility instrument, which measures performance in activities such as transfers, walking, and stair negotiation. The outcome measure is made up of six questions, making it easy and quick to complete. Jette et al found that 6-clicks showed fair to good accuracy in determining discharge destination from the initial visit. Our patient scored 11 on the AM-PAC Basic Mobility instrument during the initial visit, indicating 73% impairment.

Table 1: MMT results from the initial evaluation.

	Right	**Left**
Hip flexion	3/5	3-/5
Hip abduction	3/5	3/5
Hip adduction	3/5	3-/5
Knee flexion	3+/5	3/5
Knee extension	3+/5	3+/5
Ankle DF	2+/5	2+/5

Mobility

During the initial visit, she required moderate to maximal assist of two to three therapists for bed mobility and to complete sit to stand transfers. She attempted to transfer from bed to chair with maximal assist of three but was unable to complete transfer secondary to being unable to step with her right foot.

Clinical Impression #2

Following examination, it was clear she was functioning well below her PLOF, and was significantly impaired in strength, bed mobility, transfers, and gait. It was determined that therapy was indicated for balance, bed mobility, transfer, and gait training.

Intervention

The patient was seen five times per week by PT and encouraged to get up with nursing staff over the weekend. Interventions focused on function, and included bed mobility, transfer and gait training, therapeutic exercise, and some manual therapy techniques, progressing each as she tolerated. Each exercise technique was utilized to increase her independence with function, with the end-goal to return home. A description of each therapy session is depicted in **Table 2.**

Table 2*:* Interventions administered at each visit and description of patient performance.

Visit	Treatment	Description/Comment
1	Initial evaluation	N/A
2	Bed mobility and sit to stand training	Self-limited stand due to complain of pain in left foot and hip adductors
3	Bed mobility, transfer training, gait training	Patient able to take 4 small steps to commode
4	Bed mobility, transfer training	Able to stand 1.5 minutes. Self-limited therapy due to LE pain.
5	Therapeutic exercise, transfer training, gait training	Ambulated 30 ft x2 with front wheeled walker. Performed seated exercises (glute squeezes, long arc quads, hip abduction, ankle pumps, straight leg raise)
6	Bed mobility, transfer training, gait training	Ambulated shorter distances due to bilateral foot pain.
7	Bed mobility, gait training	Demonstrates foot slap at heel strike in bilateral LEs. Initially ambulated with step-to gait pattern due to decrease weight bearing through left LE. Able to progress to step-through gait pattern during gait training.
8	PROM, sensory assessment	Performed manual therapy techniques to allow due to patient autonomy
9	Gait training, therapeutic activity	Improved gait speed. Self-limited gait training due to pain and stress.
10	PROM, gait training	Hamstring, adductor, psoas, and iliotibial band stretch. Complaint of pain in bilateral feet and low back. Ambulated 65 ft x3 with front wheeled walker, minimal assist x1.
11	Therapeutic exercise, therapeutic activity, gait training	Performed standing exercises with front wheeled walker (heel raises, toe raises, marches, hip ab/adduction). Practiced sit to stand technique. Ambulated 80 ft x2 with front wheeled walker.
12	Gait training, stair training	Patient did not require seated rest break. Continued gait deviations. Complaint of pain with stair descent.
13	Gait training, stair training	Demonstrates improved push off in bilateral LEs, increased toe clearance in left LE, improved step length, and increased weight bearing through left LE. Continues to present with decreased toe off. Patient required minimal assist x1 during stair training, able to negotiate four steps.

Bed mobility was performed in a standard hospital bed, with bed rails utilized as needed. Transfer training was performed in the hospital room, from her bed to/from recliner or commode. Gait training was performed on level ground in hospital hallway, where the patient was exposed to few distractions and obstacles. The patient wore a gait belt prior to the start of transfers, gait, or stair negotiation training.

Sensation in bilateral lower extremities was assessed at visit 8 due to the patient continuously complaining of numbness and loss of sensation in her lower extremities, with little to no improvements since the beginning of therapy. Sensation was not assessed on initial eval due to the patient's decreased awareness and confusion. Decreased sensation was also assumed to be related to edema secondary to AKI and was thought to improve as swelling decreased. However, as swelling improved, symptoms remained, therefore, we implemented a sensory exam.

Light touch response was impaired as the patient is unable to detect light touch sensation below anterior and medial distal 1/3 of bilateral LEs, below lateral greater trochanter on LLE and lateral ½ of shank on RLE. She was also unable to identify light touch below popliteal fossa bilaterally (**Figure 1**). Deep pressure response was inconsistent in feet, however, it seemed to be intact above ankles bilaterally.

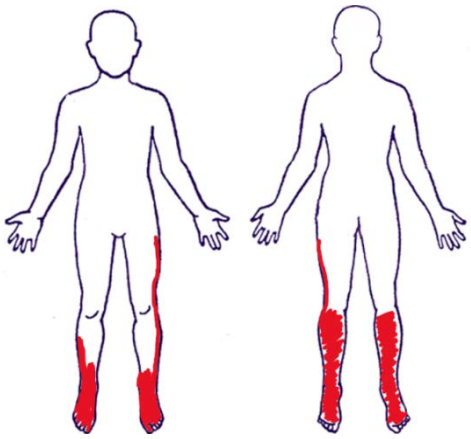

Figure 1: Sensation map obtained at visit 8. Red indicates loss of light touch sensation.

Proprioception was tested in the feet by raising or lowering each digit and asking the patient to report if the toe was up or down. The patient was unable to consistently report whether the digit was up or down and stated that she felt as if all her toes were moving at once, indicating impaired proprioception. The patient described her pain as burning or pressure, sometimes a sharp pain or soreness. Reports that if feels like her foot has bumped into something. She also added that she is unable to tell if her foot is touching something, and sometimes she feels she is touching something when she is not.

Throughout her hospital stay, the patient complained of pain in bilateral LEs during weightbearing activities. Because of this pain, she requested seated or standing rest breaks during gait training, and alternative treatments. She often reported she felt as if she could physically do more during treatments but felt limited due to her pain.

Discharge Recommendations

Initially, we recommended the patient discharge to an acute-rehab facility to promote patient success and return to prior level of function. However, insurance denied the patient ability to discharge to this facility. We also recommended the patient discharge to a skilled nursing facility (SNF) prior to returning home. During the first few visits, the patient did not want to stay in a SNF for personal reasons, but after not being accepted to acute rehab, the patient was agreeable to SNF. Again, insurance denied recommendations for discharge to SNF. After three weeks in the hospital, the patient was discharged home with home health care.

Outcomes

Performance

During initial visit, the patient required maximal assistance during supine to sitting edge of bed tasks, but by the final visit (visit 13), she was able to complete supine to sitting edge of bed transfer by herself, with the use of her upper extremities (see **Table 3**). The patient's sit to stand technique improved greatly throughout her hospital stay, as the patient required maximal assistance during the first visit but, was able to complete with supervision by visit 13. Upon initial visit, the patient was unable to complete a bed to chair transfer, but by the final visit, the patient could complete with supervision.

Gait training improved significantly throughout hospital stay. Initially, she could not ambulate within the hospital room, and by visit 13, the patient was able to ambulate 320 feet with a front wheeled walker and supervision, requiring several standing rest breaks. The patient continued to be limited in gait due to pain in LEs. Finally, the patient was able to negotiate 4 steps with minimal assistance by visit 13, whereas the patient was unable to perform during visit one.

However, she continued to have decreased sensation in bilateral LEs and complaint of significant pain in LEs with mobility. Although she showed significant improvements from initial evaluation, the patient was not functioning at prior level at discharge.

AM-PAC

The minimal detectable change (MDC) in the AM-PAC Basic Mobility form is 4.28. From first visit to 10th visit, the patient improved her AM-PAC BM score 8 points, indicating significant change has occurred (**Table 4**). However, the patient only increased 4 points from visit 10 to visit 13. The minimal clinically importance difference (MCID) for the AM-PAC BM has not yet been determined.

Table 3*:* Performance during functional activities in initial, middle, and final visit.

	Performance		
Activity	**Visit 1**	**Visit 7**	**Visit 13**
Supine > sit	Max Ax2, Min-mod Ax1. Use of bed sheet and bed rails	Mod independent. Use of bilateral UEs for support	Mod Independent.
Sit <> stand	Max Ax2, min-mod Ax1. Able to stand 1 min.	Supervision. Required cueing when she was at safe distance from chair to sit, as she reported she could not feel chair on back of bilateral LEs.	Supervision. No longer required verbal cues for positioning.
Transfer to/from chair	Max Ax3, two attempts to perform stand pivot transfer, unable to complete.	Supervision to CGA x1. Use of FWW for stand-pivot-transfer.	Supervision
Gait training	Unable to perform	30 ft x1, 50 ft x2 CGA with FWW, required seated rest break between each set.	120 ft x1, 200 ftx1 supervision with FWW. Required 1 seated rest break between sets.
Stair training	Unable to perform	Did not attempt	Min Ax1, CGAx1. Negotiates 4 steps

Max = maximal; min = minimal; mod = moderate; UEs = upper extremities; LEs = lower extremities; CGA = contact guard assist; FWW = front wheeled walker

Table 4: AM-PAC Basic Mobility scores, percentage of impairment, and G-code Modifiers from first to last visit.

	Visit 1	**Visit 10**	**Final visit**
Raw score	11	19	23
CMS 0-100% score	73%	43%	16%
G-code Modifier	CL	CK	CI

Boston University AM-PAC Basic Mobility Inpatient Short Form

Discussion

While there are only a few research investigations regarding rehabilitation following RM, one clinical review suggested the use of strengthening, stretching, aerobic conditioning, balance training, and functional mobility to address functional deficits.[1] The authors acknowledge a “complete void” in research regarding rehab in patients with RM.[1] However, it is unclear to what extent a therapist should utilize these treatments. Therefore, we utilized functional mobility activities in the hospital as the patient tolerated. One study was found which outlined the progression of a return to play program for treating patients with RM. Unfortunately, this program was designed for athletes with exertional RM, unlike our

patient.[14] Additionally, the first phase of the program begins after the patient discharges from the hospital, and it is unclear what interventions are utilized while the patient is still admitted.

While exertional RM is most commonly discussed in the medical literature, there are other case studies available documenting similar drug-induced RM, resulting in hospitalization. Lee et al discussed a patient with RM resulting in Horner's syndrome. This patient complained of upper extremity paresthesia and pain throughout admission and four months following discharge from hospital. However, 10 months after discharge, the patient had complete resolution of symptoms. This case study concluded that muscle swelling occurs secondary to edema in patients with RM and may lead to neurological symptoms.[12] Wallace described a 48-year-old man with alcohol induced RM in another case study. This patient was admitted for 21 days, with his renal function normal by day 14. There is no mention of this patient's functional mobility throughout his hospital stay, as the focus of this case study was on medical management. One case report discussed a patient diagnosed with RM following severe opioid withdrawal, instead of opioid overdose like our patient.[6] The patient's CK level peaked to 29,000 and the patient reported muscle stiffness.[6] However, this patient discharged after only three days in the hospital, whereas our patient was admitted for three weeks. Again, no PT interventions were mentioned.

The case study most like our patient was discussed by Ko et al. The patient was a 49-year-old female taking anti-depressants. After three weeks in the hospital, the patient's lab findings were normalized, however, the patient continued to complain of pain in LEs.[11] The patient was later diagnosed with bilateral sciatic neuropathy believed to be caused by increased tissue gluteal compartment pressure and swelling.[11] Our patient, too, complained on bilateral pain in LEs, even after kidney and other lab findings were normalized. We are uncertain what caused pain and paresthesia in our patient's LEs. Further assessment should be done in patients with RM that continue to complain of pain and paresthesia in LEs.

Research for PT management is lacking in patients with RM. Most of the research in middle-aged patients discussed medical management in patients with RM and fails to address mobility and functional management.

It is important to note that our patient was unable to discharge to our initial recommended facility due to insurance. Because of this, we were forced to alter our treatment plans to prepare her to discharge home. She was discouraged after being denied from multiple facilities and was anxious to discharge home as she felt she was not ready and would not have a successful discharge. Although the patient could ambulate home distances and negotiate steps with minimal assistance, our patient would likely have incredible difficulty completing ADLs independently. We did not follow-up with patient following discharge to see how the patient was able to progress.

Limitations

It is noted that neuropathy is not addressed in this patient while she is admitted to the hospital. An electromyogram (EMG) was administered near end of the patient's stay due to numbness in arm and LE weakness. The EMG was only performed on the left LE. The report concludes that the tests suggests axonal polyneuropathy in left LE. We initially believed the numbness was related to edema and would improve as the swelling decreased and the patient was able to increase mobility, however, that was not the case. Thorough sensory testing should be done during initial evaluation and tracked throughout hospital stay in patients with RM.

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